Department of Electronic and Telecommunication Engineering

University of Moratuwa

EN2160 – Electronic Design Realization

Automatic Hand Sanitizer Dispenser

Final Project Report

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Product Description

In response to the critical challenges posed by traditional hand sanitization methods, we proudly present our revolutionary Touchless Automatic Hand Sanitizer Dispenser. As the world faced unprecedented health concerns, the importance of maintaining optimal hand hygiene became evident. Conventional hand sanitizer dispensers often involved physical contact, leading to potential cross-contamination risks and undermining efforts to ensure a safe and hygienic environment.

The Touchless Automatic Hand Sanitizer Dispenser was conceived to address these pressing issues and revolutionize hand sanitization practices. Emphasizing both safety and convenience, this innovative dispenser eliminates the need for direct contact, setting a new standard for hygienic hand sanitization. Users can now enjoy a seamless and efficient experience without compromising their well-being.

One of the key drivers behind implementing this product is the desire to promote user safety beyond conventional sanitization methods. By integrating a smart temperature sensor, the dispenser takes hand hygiene to the next level. As users sanitize their hands, the built-in temperature sensor discreetly measures their hand temperature. Should the temperature exceed normal values, the dispenser promptly sounds a subtle buzzer alert, empowering users to take immediate precautionary measures. This unique feature is particularly crucial in identifying potential health concerns and encouraging individuals to prioritize their well-being.

Beyond its advanced safety features, our Touchless Automatic Hand Sanitizer Dispenser optimizes user experience through a user-friendly display screen. This display provides real-time information, such as hand temperature and keeps the users well-informed. The inclusion of this display ensures that users can take proactive steps to maintain their health and hygiene effectively.

Designed with versatility in mind, this dispenser is suitable for a diverse range of settings. From bustling public spaces to corporate offices, healthcare facilities, and homes, its adaptability makes it an ideal choice for various applications. By catering to both personal and professional needs, we aim to contribute to improved hand hygiene practices on a global scale.

In developing this touchless dispenser, we embrace the power of innovation to redefine industry standards. Our commitment to providing effective, user-centric, and forward-thinking solutions underpins every aspect of this product's design. As a responsible player in the health and hygiene industry, we wholeheartedly believe that the Touchless Automatic Hand Sanitizer Dispenser can make a meaningful impact on hand hygiene practices, thus contributing to safeguarding the well-being of individuals and communities worldwide.

Specifications

1. **Dimensions:**
    - Height: 20 cm
    - Width: 10 cm
    - Depth: 11.5 cm
2. **Weight:**
    - Around 400 g
3. **Power Source:**
    - 3.7 V li-po battery
4. **Sanitizer Capacity:**
    - 500 ml
5. **Dispensing Mechanism:**
    - Touchless Motion Sensor Technology
6. **Temperature Sensor Range:**
    - -70°C to 380°C
7. **Materials Used:**
    - Plastic
8. **Sanitizer Compatibility:**
    - Compatible with any hand sanitizer brand
9. **Mounting Options:**
    - Wall-mountable
10. **Additional Features:**
    - Durable and easy-to-clean construction
    - Suitable for indoor and outdoor use

Components and Materials

1. **Main Electronic Components:**

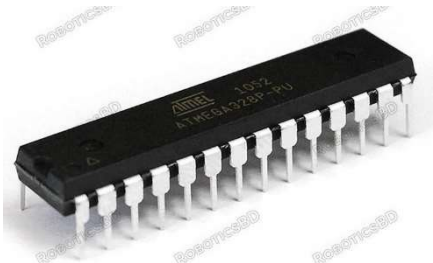
    - Motion Sensor: The Touchless Automatic Hand Sanitizer Dispenser utilizes a HC-SR04 motion sensor to detect the presence of a user's hand accurately. This sensor initiate the dispensing process without requiring any physical contact, ensuring a hygienic and touchless experience.

    - Temperature Sensor: Incorporated into the dispenser is a MLX90614 temperature sensor, which measures the hand temperature of the user during the sanitization process. The temperature sensor adds an extra layer of safety, promptly alerting users with a discreet buzzer if the hand temperature exceeds normal values.

    .

2. **Microcontroller:**

    - A ATmega328P microcontroller serves as the brain of the dispenser, controlling its various functions and managing data from the sensors. This microcontroller ensures seamless operation and efficient interaction between components, delivering a reliable and user-friendly experience.



3. **Power Supply:**

    - The Touchless Automatic Hand Sanitizer Dispenser can be powered by a 3.7V li-ion battery.

4. **Sanitizer Dispensing Mechanism:**

    - The dispenser's sanitization mechanism incorporates a DC water pump that efficiently regulates the flow of sanitizer. Upon detecting a user's hand through the motion sensors, the pump releases a fine mist of sanitizer for complete hand coverage.

5. **Sanitizer Reservoir:**

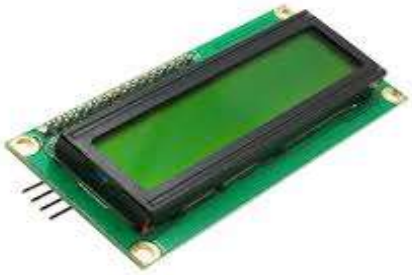
    - The dispenser features a capacious sanitizer reservoir, crafted from durable and easy-to-clean materials. The large capacity ensures extended usage periods, minimizing the need for frequent refills. The reservoir's transparent design allows users to monitor sanitizer levels conveniently.

6. **Casing and Enclosure:**

    - The dispenser's robust and stylish casing is constructed from high-quality ABS plastic, ensuring durability and resistance to wear and tear. The ergonomic design complements any environment, making it suitable for various settings.

7. **Display Screen Type:**

    - A user-friendly 16 x 2 LCD display screen is seamlessly integrated into the dispenser, providing real-time information to users. The high-contrast screen presents essential details such as hand temperature allowing users to stay informed and take proactive measures.



8. **Buzzer Component:**

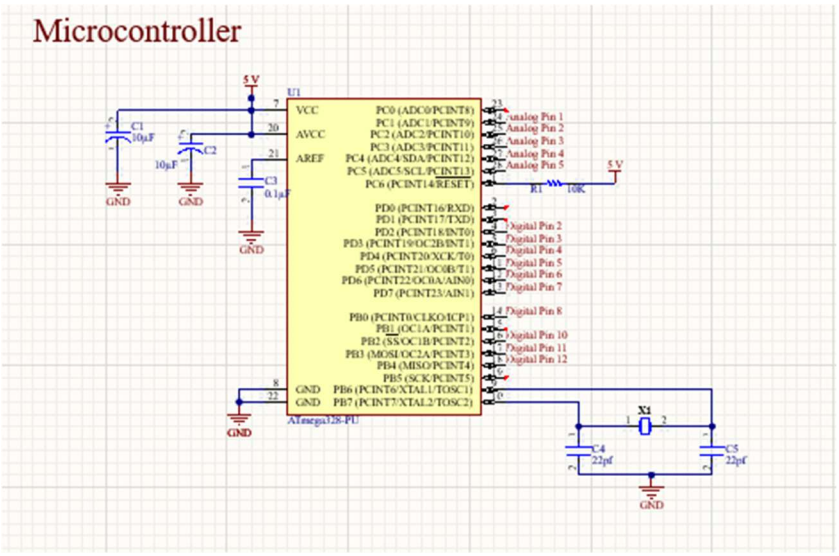
    - An integrated audio component generates the subtle buzzer alert when the temperature sensor detects a hand temperature above normal value. The buzzer's sound level is carefully calibrated to be informative without causing discomfort.

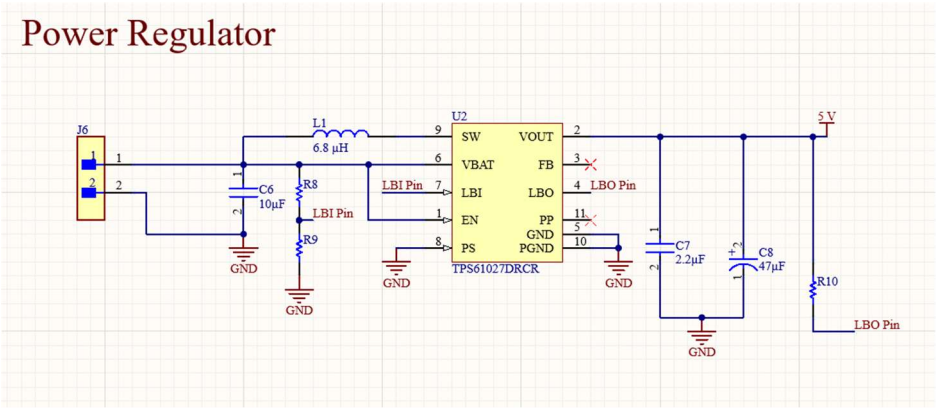
9.Wiring and Circuitry:

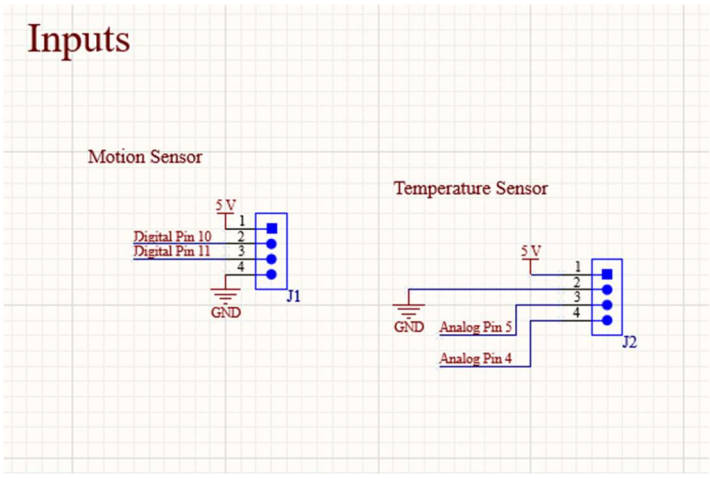
- The dispenser's internal wiring and circuitry are meticulously designed and arranged to optimize space and prevent any interference between components. The layout ensures reliability and ease of assembly during manufacturing.

Circuit Diagrams and Schematics

Schematic Diagrams

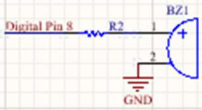




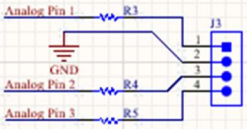


Outputs

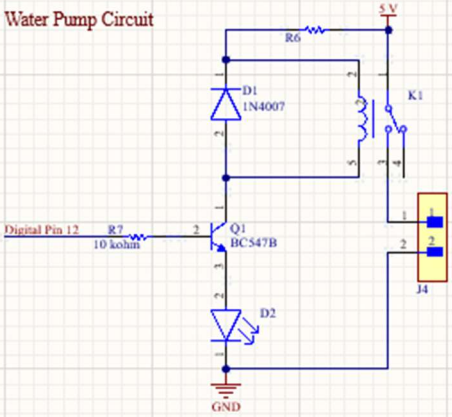
Buzzer



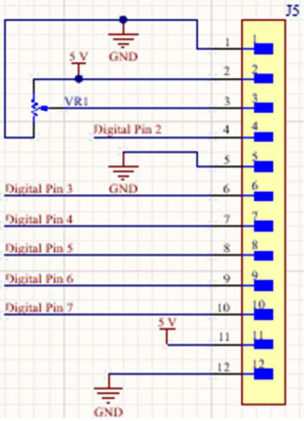
RGB LED



Water Pump Circuit

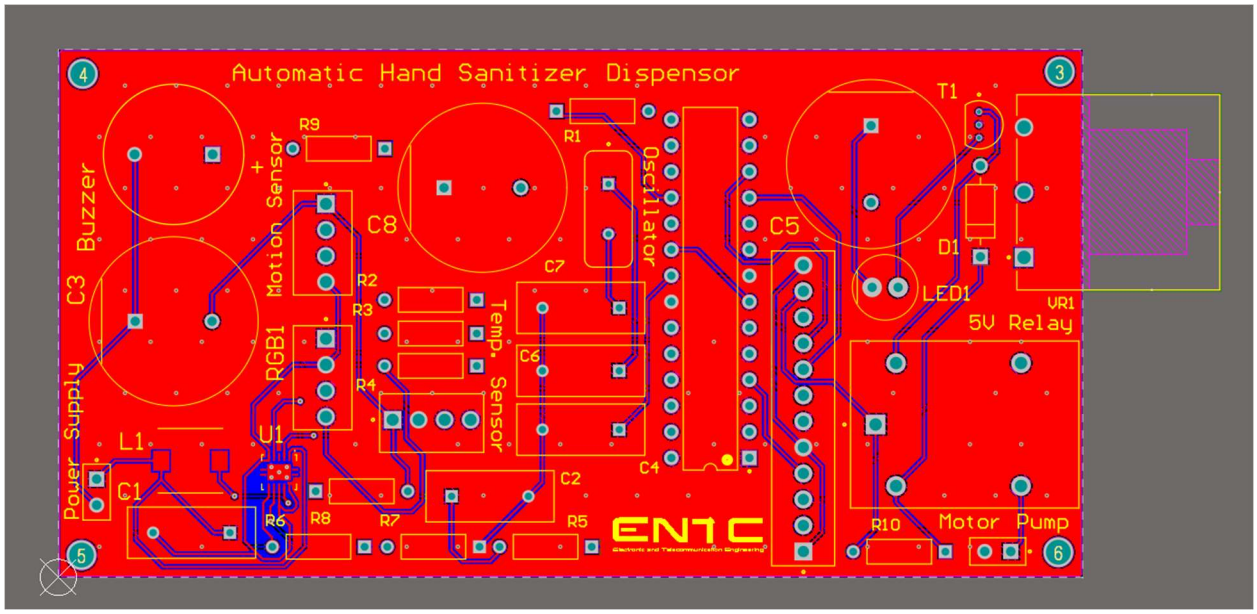


LCD Display

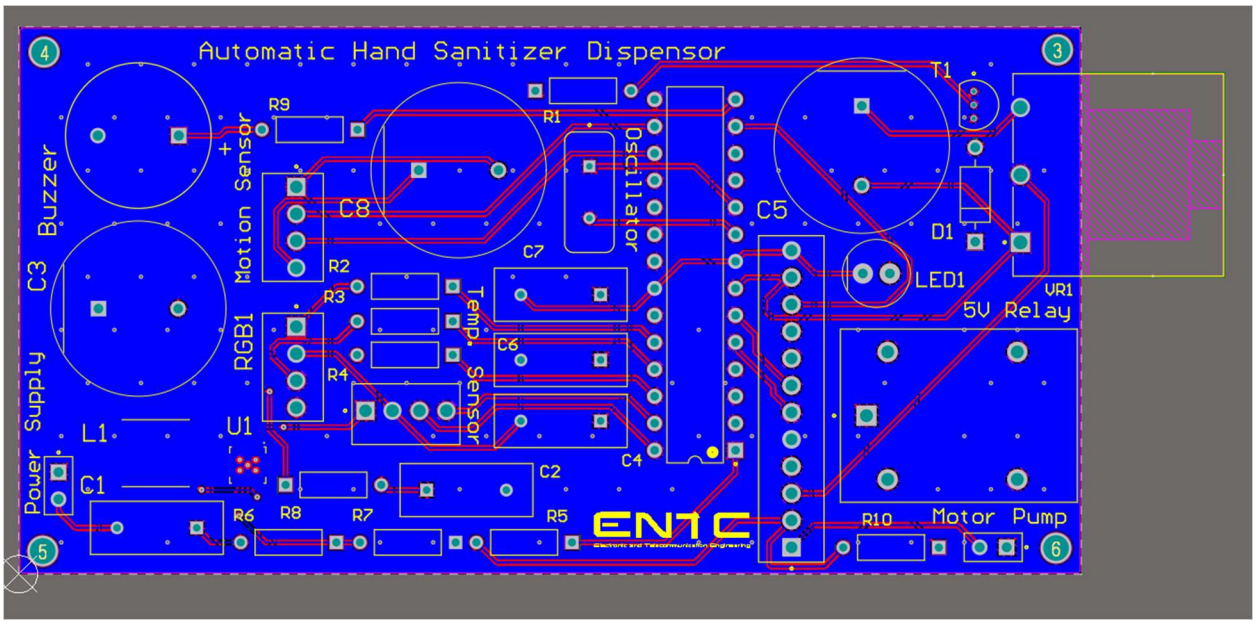


2D Layout Mode

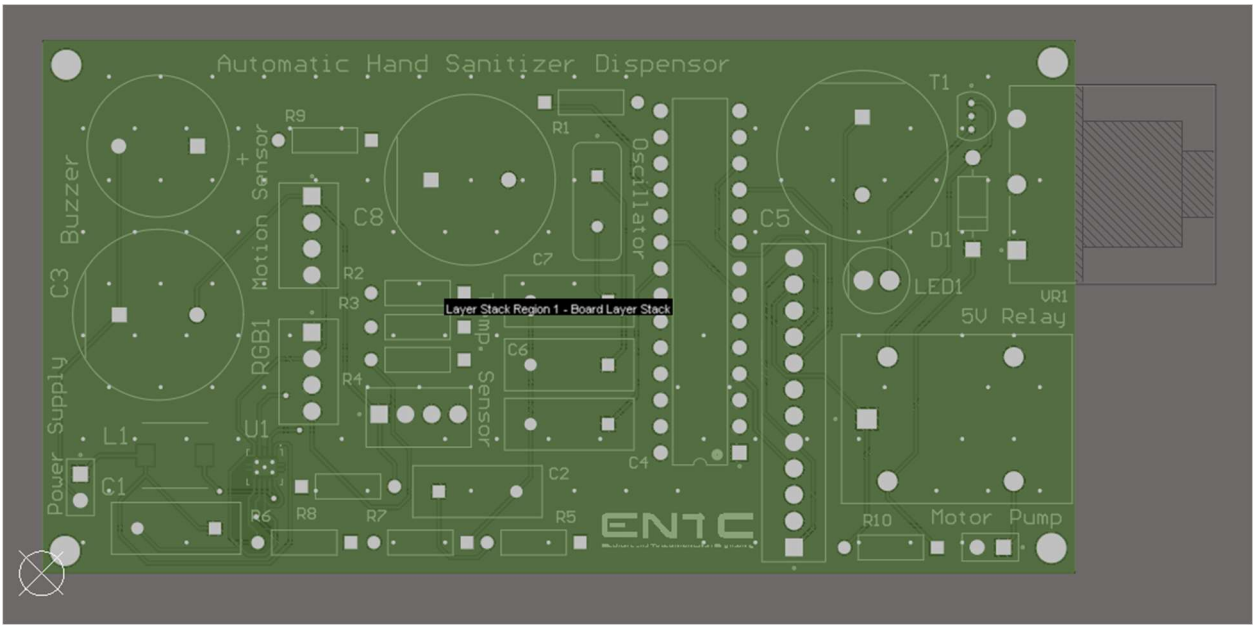
Top Layer



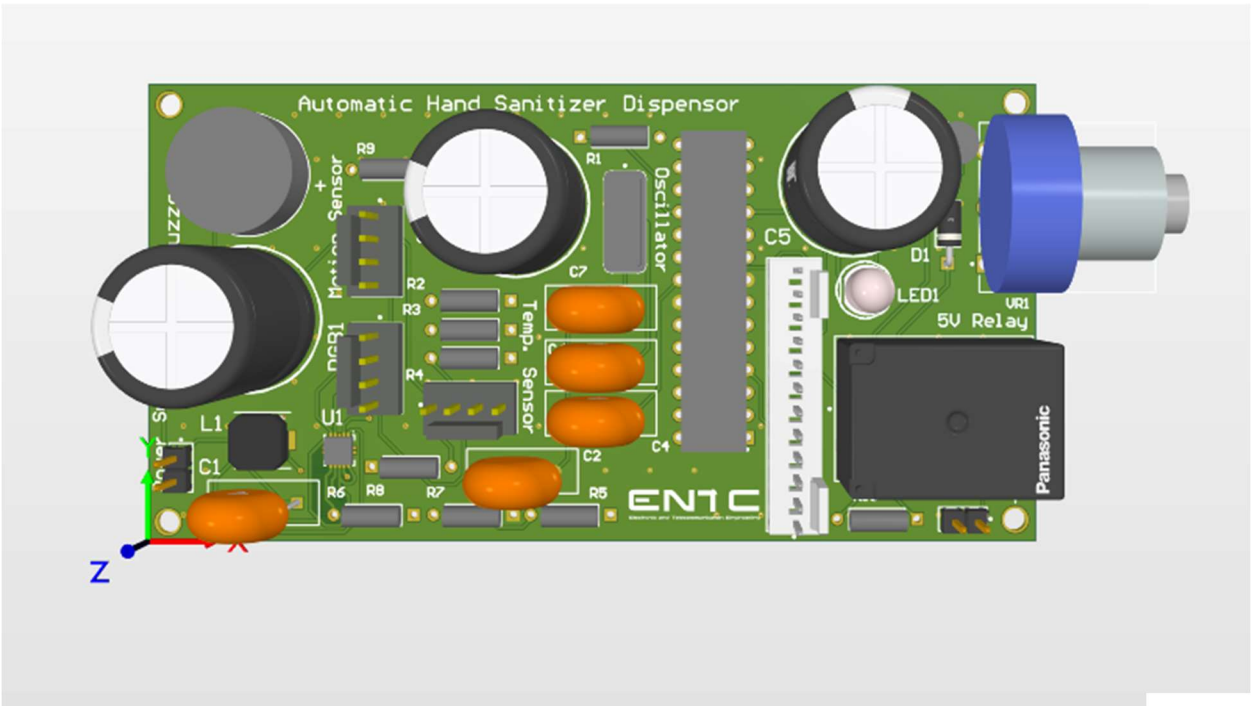
Bottom Layer



Board Planning Mode

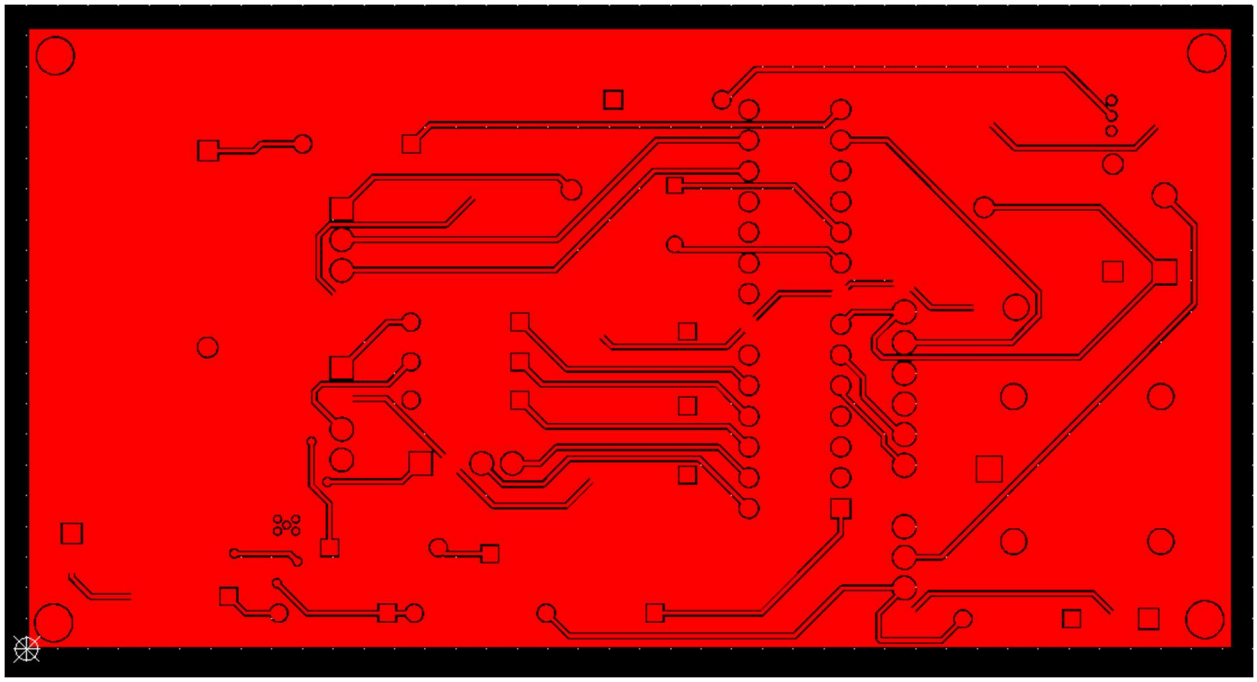


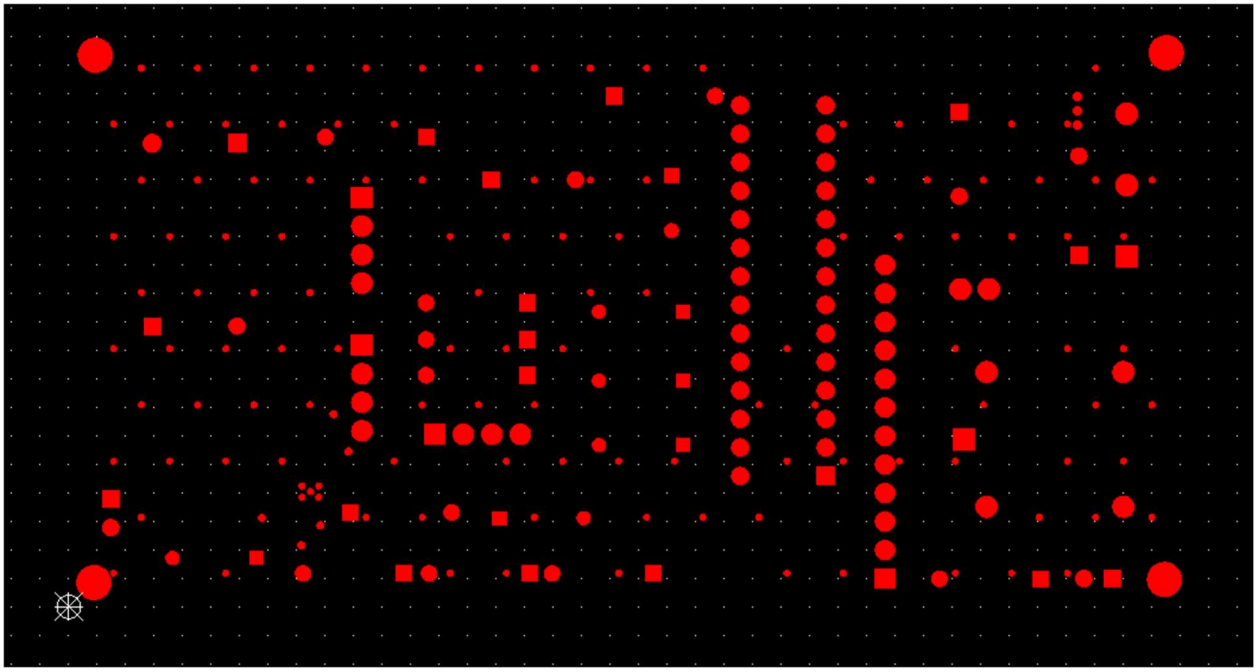
3D layout Mode



Gerber Files

Bottom layer





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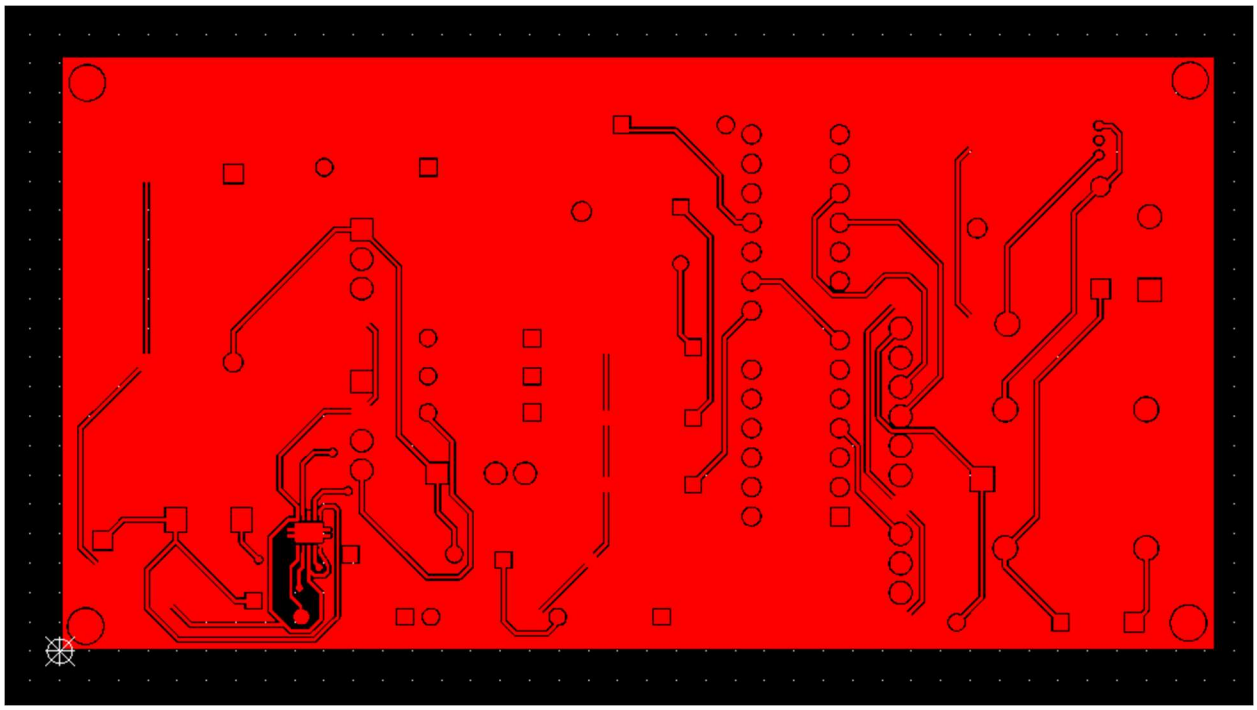
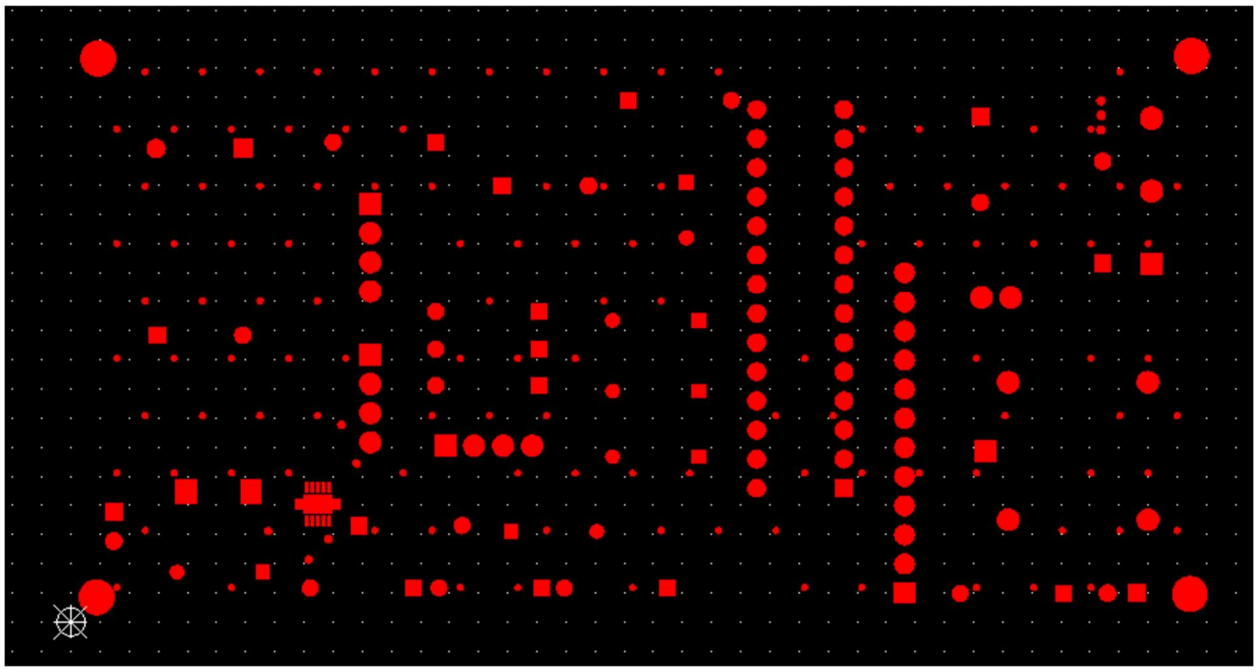
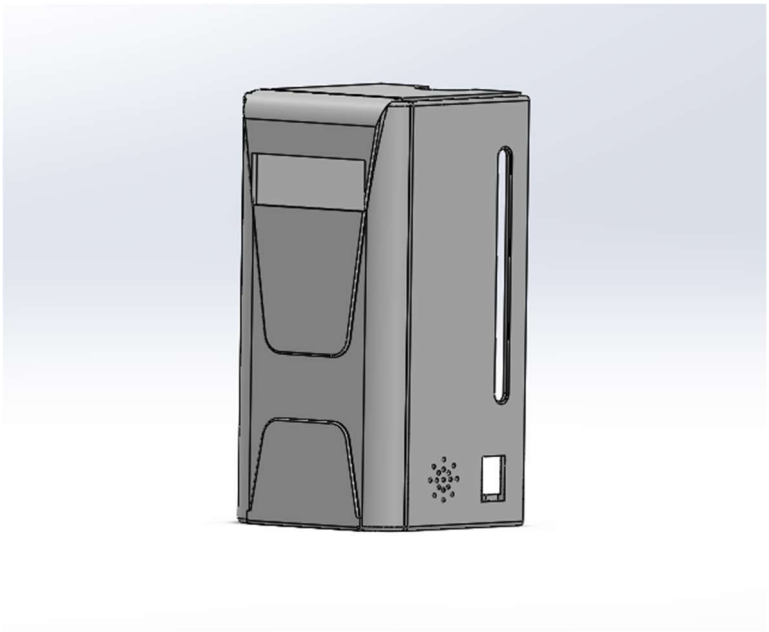
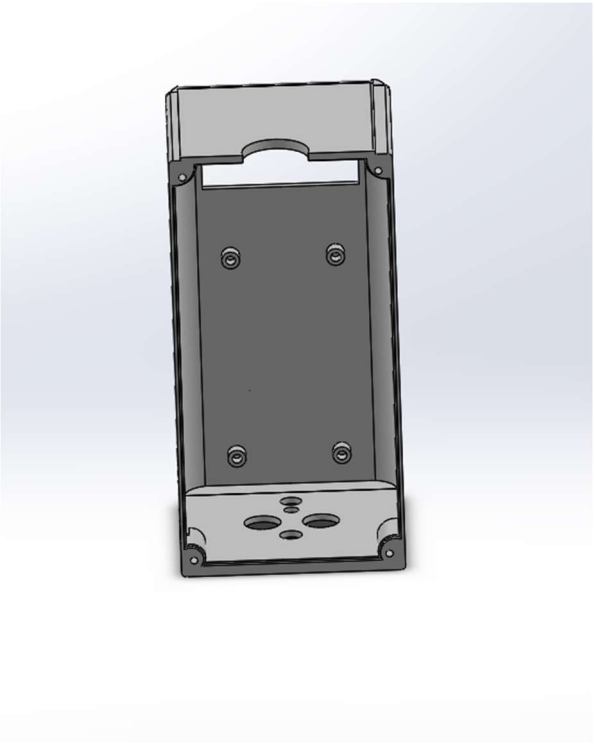
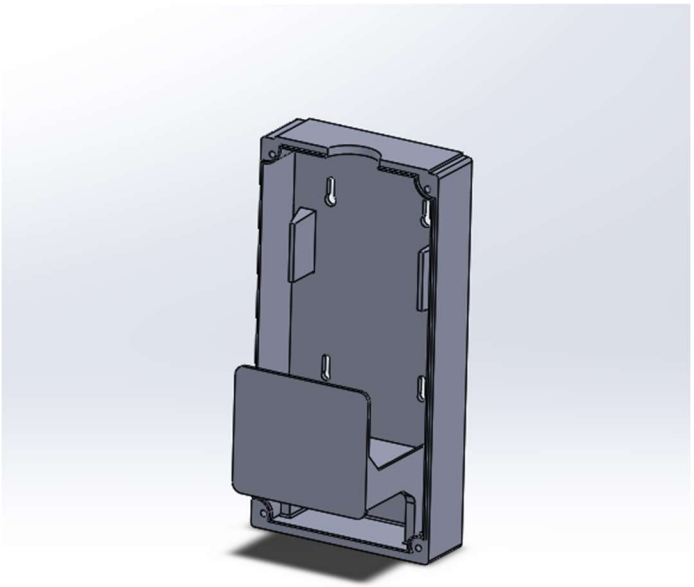


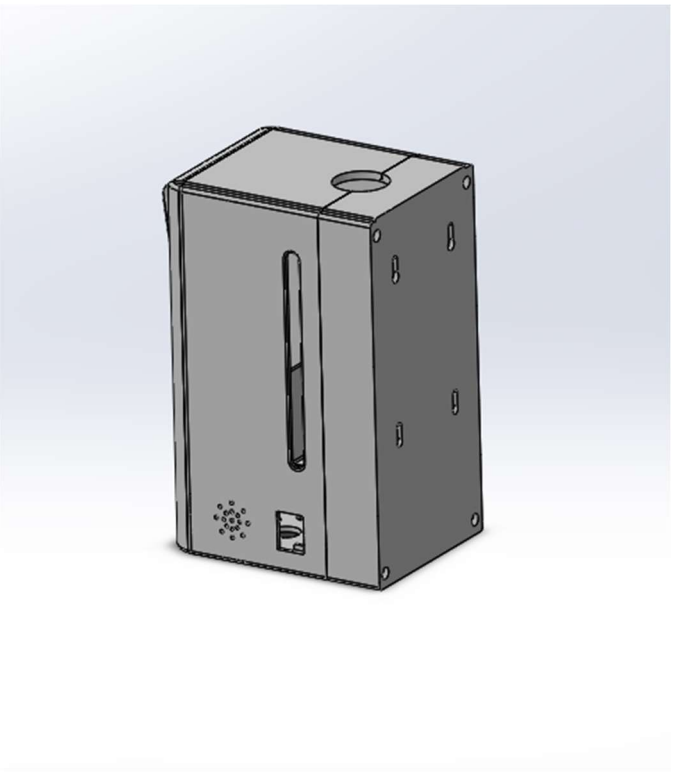


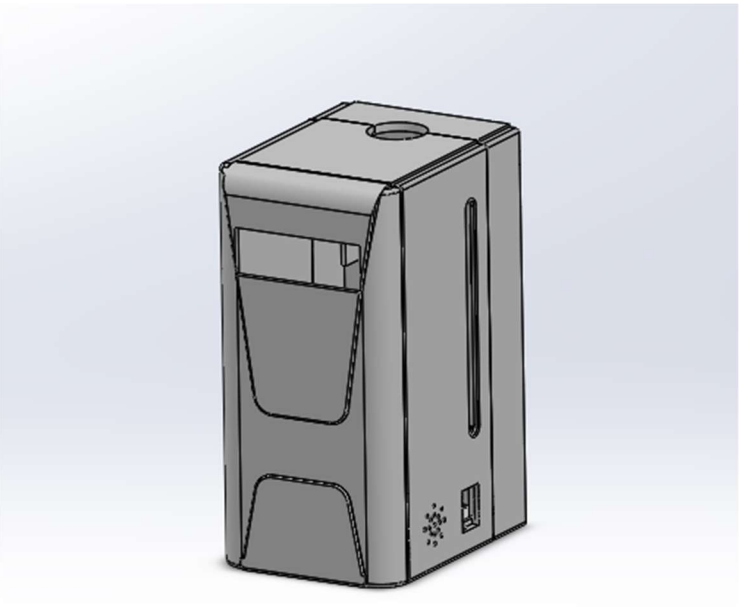
Enclosure Designs

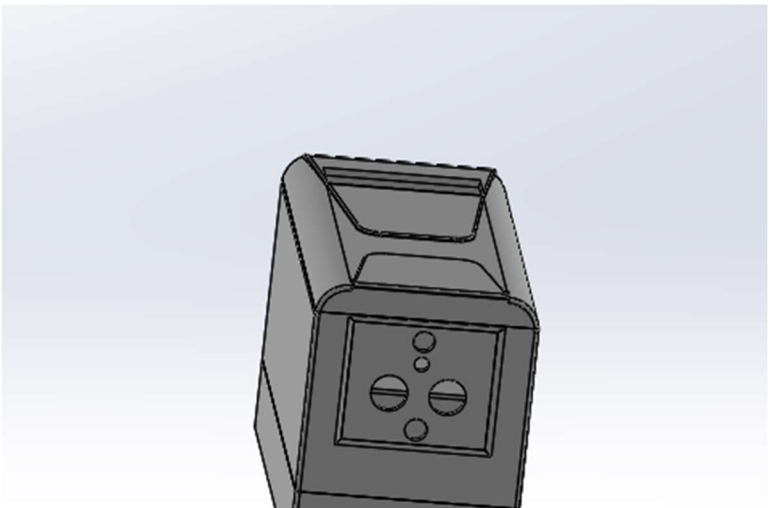












Code

```
#include <LiquidCrystal.h> // includes the LiquidCrystal Library
#include <Wire.h>
#include <Adafruit_MLX90614.h>
Adafruit_MLX90614 mlx = Adafruit_MLX90614();
LiquidCrystal lcd(2, 3, 4, 5, 6, 7); // Creates an LCD object. Parameters: (rs, enable, d4, d5, d6, d7)

// defines pins numbers
const int buzzerPin = 8;
const int trigPin = 10;
const int echoPin = 11;
const int motorPin = 12;
const int redPin = A1;
const int bluePin = A2;
const int greenPin = A3;

// defines variables
long duration;
int distance;
float temp;

void setup()
{
  pinMode(redPin, OUTPUT);
  pinMode(bluePin, OUTPUT);
  pinMode(greenPin, OUTPUT);
  pinMode(motorPin, OUTPUT);
  pinMode(buzzerPin, OUTPUT);
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input
  Serial.begin(9600);
  mlx.begin();
  lcd.begin(16,2); // Initializes the interface to the LCD screen, and specifies the dimensions (width and height) of the display
}

void loop()
{
  lcd.setCursor(1,0);
  lcd.print("Automatic Hand");
  lcd.setCursor(4,1);
  lcd.print("Sanitizer");
  analogWrite(bluePin, 255);
```

```
  analogWrite(greenPin, 0);
  analogWrite(redPin, 0);
  delay(3000);
  // Clears the trigPin

  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  // Sets the trigPin on HIGH state for 10 micro seconds
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  // Reads the echoPin, returns the sound wave travel time in microseconds
  duration = pulseIn(echoPin, HIGH);
  // Calculating the distance
  distance = duration * 0.034 / 2;

  if ((distance > 0) && (distance < 20))
  {
    temp = mlx.readObjectTempC();
    lcd.setCursor(1,0); // Sets the location at which subsequent text written to
the LCD will be displayed
    lcd.print("Temperature is");
    lcd.setCursor(2,1); // Sets the location at which subsequent text written to
the LCD will be displayed
    lcd.print(temp);
    lcd.setCursor(7,1); // Sets the location at which subsequent text written to
the LCD will be displayed
    lcd.print("Celcius");
    digitalWrite(motorPin, HIGH);
    analogWrite(bluePin, 0);
    analogWrite(greenPin, 255);
    analogWrite(redPin, 0);
    delay(2000);
    digitalWrite(motorPin, LOW);
    lcd.clear(); // Clears the display


    if (temp > 40.00)
    {
      analogWrite(greenPin, 0);
      analogWrite(redPin, 255);
      analogWrite(bluePin, 0);
      lcd.setCursor(0,0); // Sets the location at which subsequent text written
to the LCD will be displayed
      lcd.print("High Temp");
```

```
      tone(buzzerPin, 1000); // Send 1KHz sound signal...
      delay(3000);
      noTone(buzzerPin);     // Stop sound...
      lcd.clear(); // Clears the display
      analogWrite(redPin, 0);
      analogWrite(greenPin, 0);
      analogWrite(bluePin, 255);
    }
    analogWrite(greenPin, 0);
    analogWrite(bluePin, 255);
    analogWrite(redPin, 0);
    lcd.setCursor(0,0); // Sets the location at which subsequent text written to
the LCD will be displayed
    lcd.print("Have a Good Day");
    lcd.setCursor(3,1); // Sets the location at which subsequent text written to
the LCD will be displayed
    lcd.print("Thank you");
    delay(2000);
    lcd.clear(); // Clears the display
  }

}
```

Bill of Materials (BOM)

Component	Quantity	Amount
Atmega328p chip	1	LKR 1510
MLX90614 sensor	1	LKR 5750
HC-SR04 sensor	1	LKR 300
TPS61027 Regulator	1	LKR 400
DC Pump motor	1	LKR 380
Buzzer	1	LKR 50
16 x 2 LCD Display	1	LKR 700
5V Relay	1	LKR 120
BC547 Transistor	1	LKR 120
1N4007 Diode	1	LKR 60
5 K Variable Resistors	2	LKR 40
47 mF Capacitors	6	LKR 100
10 mF Capacitors	5	LKR 60
16 MHz oscillator	1	LKR 35

Assembly Instructions

To ensure a seamless and efficient assembly process for the Touchless Automatic Hand Sanitizer Dispenser, follow these step-by-step instructions carefully. Proper assembly is crucial for delivering a high-quality product to end-users.

Step 1: Casing and Enclosure Assembly

1. Begin by placing the main body of the dispenser on a clean, flat surface.
2. Align the front and back sections of the casing, ensuring all screw holes and connectors match.
3. Carefully insert the internal components, such as the motion sensors, temperature sensor and display screen, into their respective slots inside the casing.
4. Secure the casing by tightening the screws provided in the designated locations. Ensure a snug fit, but do not overtighten.

Step 2: Sanitizer Reservoir Installation

1. Insert the sanitizer reservoir into the designated compartment on the dispenser body.
2. Ensure the reservoir is securely seated in place and that the connecting tubes are aligned with the dispensing mechanism.

Step 3: Dispensing Mechanism Integration

1. Position the dispensing mechanism over the sanitizer reservoir's connecting tubes.
2. Carefully align the dispensing mechanism with the motion sensors to ensure proper dispensing activation.
3. Fasten the dispensing mechanism to the casing using the screws provided.

Step 4: Electrical Connections

1. For battery-operated models, insert the required batteries into the battery compartment, following the polarity indicated.
2. If the dispenser is electrically powered, connect the power supply to the designated input port on the dispenser.

Step 5: Display Screen and Buzzer Attachment

1. Gently connect the display screen to its corresponding connector on the PCB.
2. Attach the buzzer component to the designated location on the dispenser casing.

Step 6: Final Checks

1. Perform a thorough visual inspection to ensure all components are properly seated and secured.
2. Verify that all electrical connections are correct and secure.
3. Double-check the functionality of the motion sensors, temperature sensor, and display screen.

4. Conduct a dry run of the dispenser to test the dispensing mechanism and buzzer alert.

Step 7: Quality Control and Testing

1. Before proceeding with mass production, subject the assembled dispenser to comprehensive testing, as detailed in the "Testing and Quality Control" section of this report.
2. Perform quality control inspections to identify and rectify any assembly defects or issues.

Step 8: Packaging

1. Once assembly and quality control checks are complete, carefully package the Touchless Automatic Hand Sanitizer Dispensers according to the specified packaging requirements.
2. Include user manuals and relevant documentation in the packaging.

By adhering to these assembly instructions, can ensure the consistent production of a high-quality Touchless Automatic Hand Sanitizer Dispenser. Proper assembly and thorough testing are essential to delivering a reliable and user-friendly product that promotes optimal hand hygiene practices.

Testing the functionality of the product

To ensure the Touchless Automatic Hand Sanitizer Dispenser operates efficiently and delivers a superior user experience, a series of functional tests are conducted. The testing process focuses on verifying that all the dispenser's components and features function as intended. The following outlines the key steps to test the functionality of the product:

1. Touchless Hand Detection Test:

- Purpose: Verify that the motion sensors accurately detect a user's hand and trigger the sanitizer dispensing process.
- Procedure: Place various hand positions and motions under the dispenser to assess the responsiveness of the motion sensors.
- Expected Outcome: The dispenser should promptly detect the presence of a hand and initiate the sanitizer dispensing without requiring physical contact.

2. Temperature Sensor Test:

- Purpose: Confirm that the temperature sensor accurately measures the hand temperature during the sanitization process.
- Procedure: Perform tests with hands at different temperatures, including normal and elevated levels, to validate the sensor's accuracy.
- Expected Outcome: The temperature sensor should provide precise temperature readings and trigger the buzzer alert if the hand temperature exceeds the defined threshold.

3. Sanitizer Dispensing Test:

- Purpose: Ensure that the dispenser dispenses an appropriate and consistent amount of sanitizer during each use.
- Procedure: Measure the volume of sanitizer dispensed during multiple cycles and compare the results against the specified amount.
- Expected Outcome: The dispenser should dispense a consistent volume of sanitizer with each use, minimizing both wastage and insufficient dispensing.

4. Display Screen and Buzzer Test:

- Purpose: Validate the functionality of the display screen and buzzer for providing real-time information and alerts.
- Procedure: Confirm that the display screen accurately shows hand temperature and sanitizer level. Trigger the temperature sensor to verify the buzzer alert functionality.
- Expected Outcome: The display screen should present accurate information, and the buzzer alert should be activated when the hand temperature exceeds the normal threshold.

5. Power Source Test (if applicable):

- Purpose: Evaluate the performance of battery-operated models or the electric power source for electrically powered dispensers.
- Procedure: Monitor the battery life or power supply stability during prolonged usage to assess performance and longevity.
- Expected Outcome: The power source should provide sufficient power for the dispenser's expected operational duration.

6. Durability and Longevity Test:

- Purpose: Assess the dispenser's durability and ability to withstand continuous use over an extended period.
- Procedure: Subject the dispenser to repeated dispensing cycles and simulate real-world usage scenarios.
- Expected Outcome: The dispenser should maintain its performance and structural integrity throughout the durability testing.

7. User Experience Evaluation:

- Purpose: Gather feedback from users to evaluate the overall user experience and identify potential areas for improvement.
- Procedure: Allow selected individuals or focus groups to use the dispenser and provide feedback on usability, convenience, and satisfaction.

- Expected Outcome: User feedback should inform product refinements that enhance the overall user experience.

By conducting these comprehensive functional tests, manufacturers can ensure that the Touchless Automatic Hand Sanitizer Dispenser performs optimally, adheres to the specified requirements, and delivers a reliable and user-friendly solution for effective hand sanitization. Any issues identified during testing are addressed and resolved to guarantee a high-quality product that meets or exceeds customer expectations.